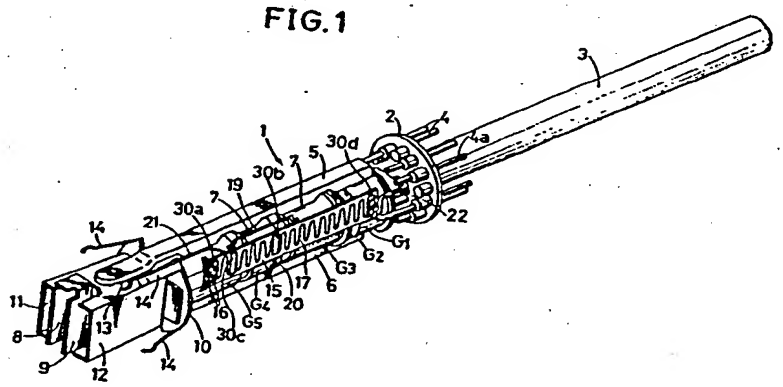
(12) UK Patent Application (19) GB (11) 2 028 576 A

(21) Application No 7924700
(22) Date of filing 16 Jul 1979
(23) Claims filed 16 Jul 1979
(30) Priority data
(31) 53/086507
(32) 15 Jul 1978
(33) Japan (JP)
(43) Application published
5 Mar 1980
(51) INT CL³
H01C 7/00 H01J 29/48
(52) Domestic classification
H1D 18C 34 4A4 4A7 4B2
4E3A 4E4 4K4 4K7D 4K7Y
4K8 4X5 9A 9Y
C1M 235 251 254 261 AC
H1S 5 6A3 8A CK
(56) Documents cited
GB 1482040
GB 1465931
GB 1404694
GB 1370041
GB 1306089
GB 1295517
GB 1234157
GB 1224527
GB 1151658
GB 1148926
GB 1088889
GB 794848
(58) Field of search
H1D
H1S
(71) Applicants
Sony Corporation, 7—35
Kitashinagawa-6,
Shinagawa-ku, Tokyo,
Japan
(72) Inventors
Shoichi Muramoto,
Yoshihiro Tsukamura,
Masayuki Tozawa,
Fusao Ishii
(74) Agents
D. Young & Co.

(54) Electron guns and resistors for cathode ray tubes

(57) An electron gun 1 in a c.r.t. (eg colour picture tube) has focusing and accelerating electrodes G_1 to G_5, and divider resistance element 15 comprising a ceramic substrate coated with layer 17 of resistive material, one end being electrically connected to the anode potential, and the other to a pin 4 at a low enough potential to avoid electric discharge between that pin and other stem lead pins. Potential for the electrodes is derived from intermediate taps *a, b* of the resistor. The resistive material is composed of a mixture of RuO_2 and glass frit and is overcoated with a glass layer (32) (Fig 7A not shown), the coefficients of thermal expansion of substrate and glass layer being similar. The frit glass may be borosilicate, and the oxide may include Ti or Al_2O_3 additions and specified organic binder and solvent. Component concentrations and resistor dimensions are exemplified. Electrodes (30a—d) (Fig 5A, not shown) are also preferably RuO_2/glass. Overcoating glass layer or layers (32) (Fig 7B not shown) may be Al_2O_3/borosilicate Pb glass in specified ratios. Characteristics are discussed wrt Figs 8, 9 (not shown). The arrangement requires only one anode button in the c.r.t. and counters vapourization and sputtering during the knocking process to remove burrs. Guard patterns (31a—f) (Fig 5A) further counter arc formation on the electrodes and prohibit sputtering.

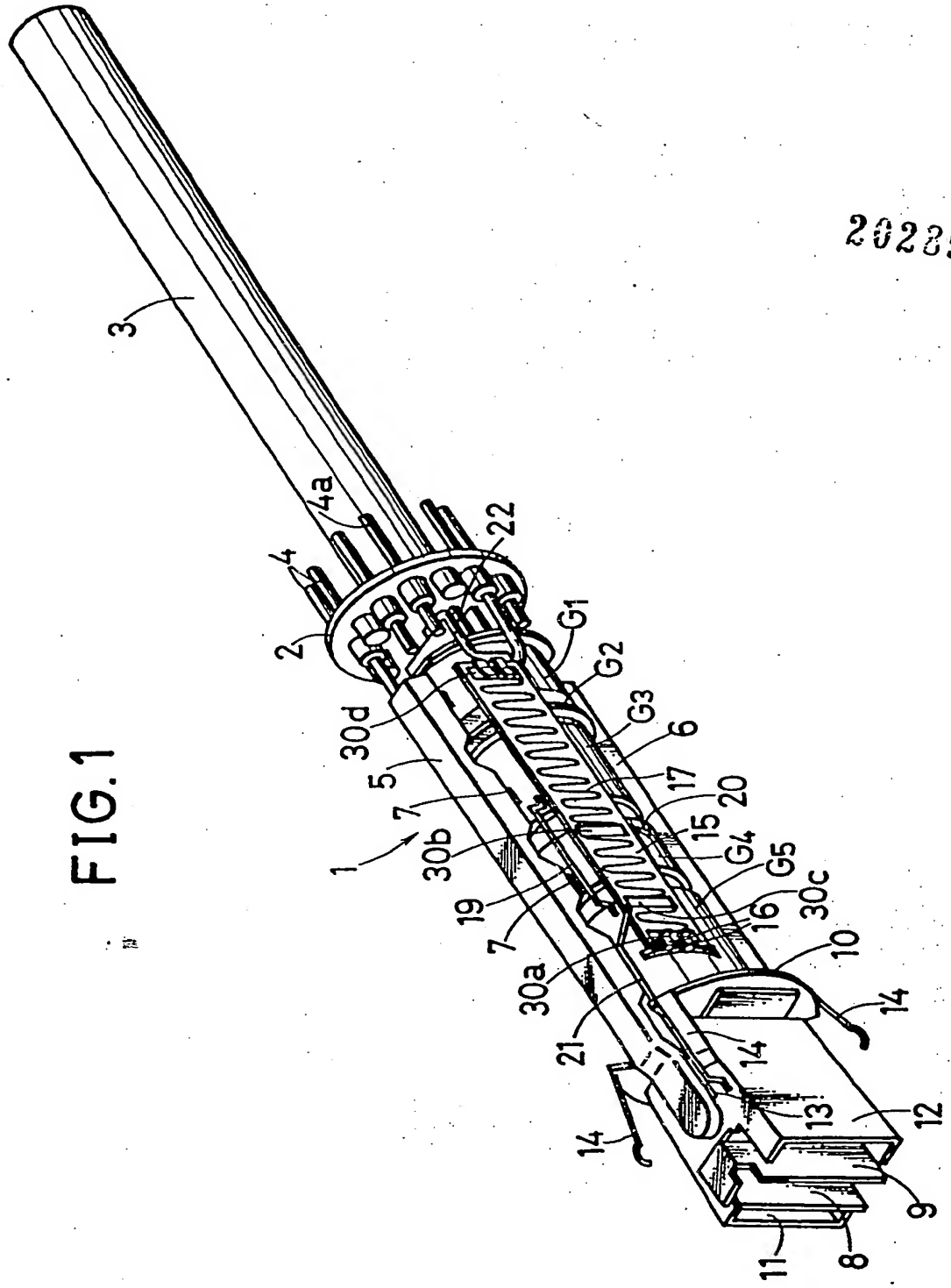
FIG.1



GB 2 028 576 A

2028576

FIG.1



2028576

FIG.2

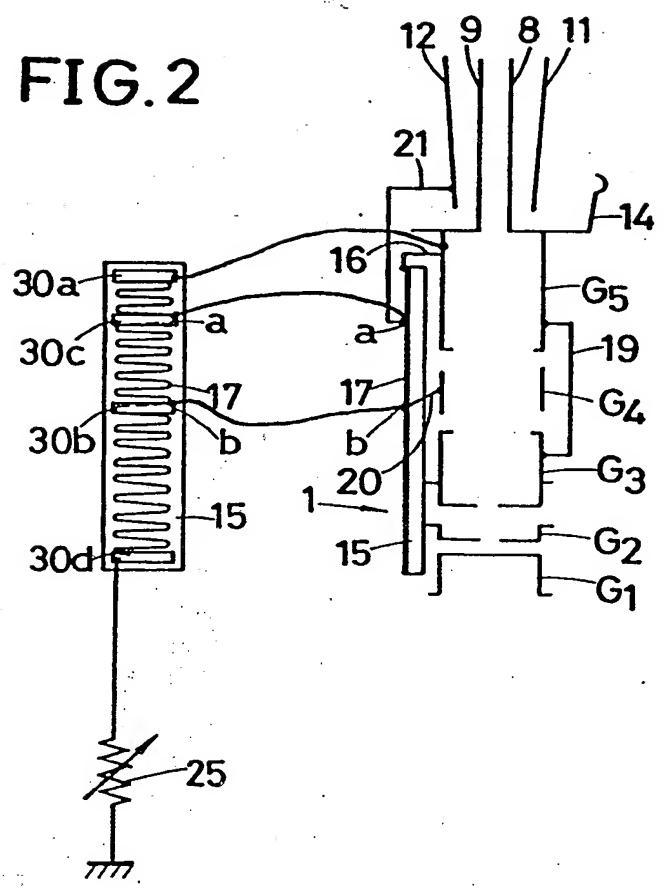
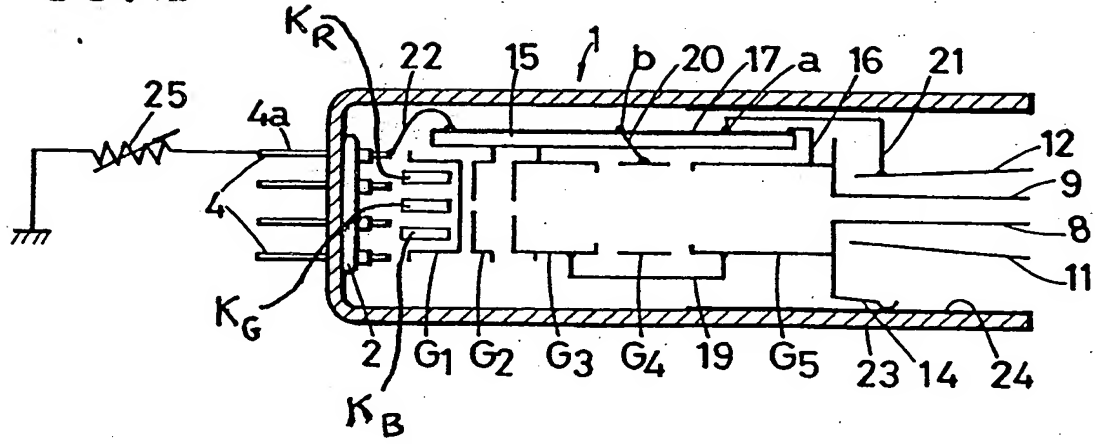


FIG.3



2028576

FIG.4

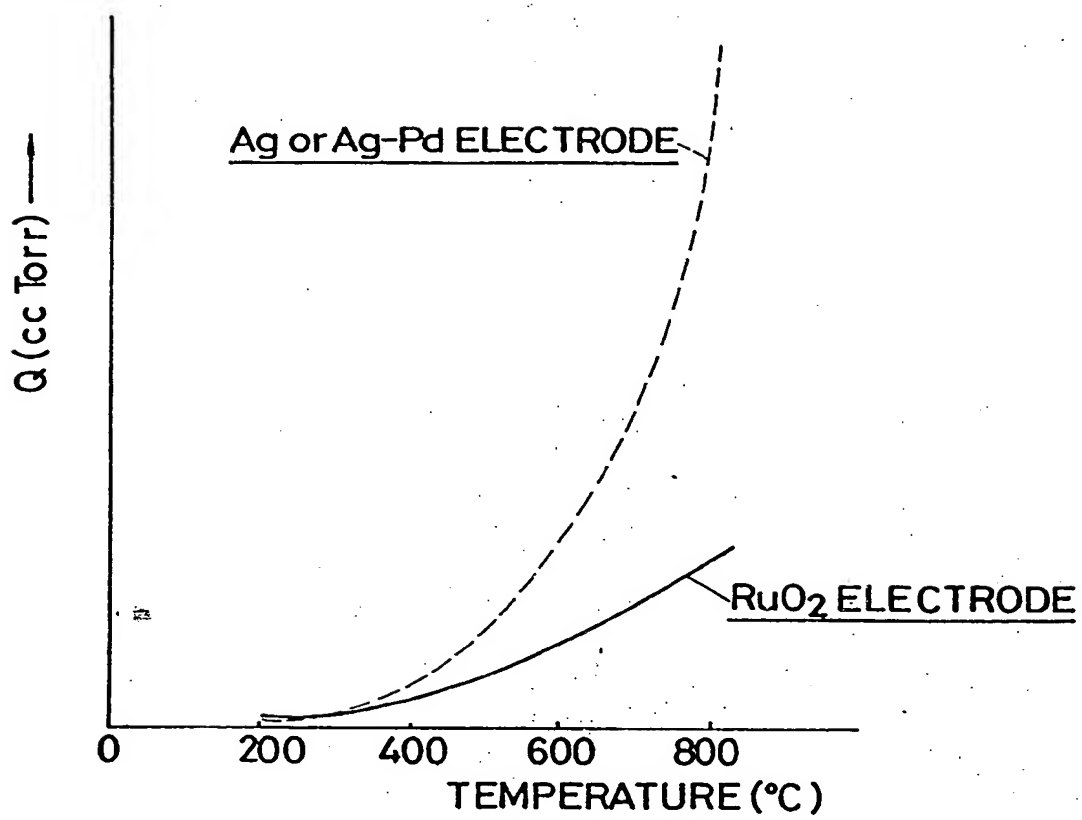


FIG.5A

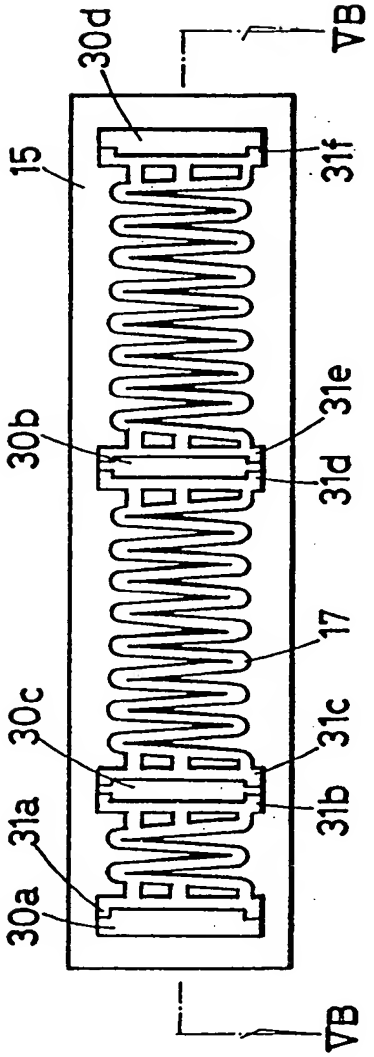
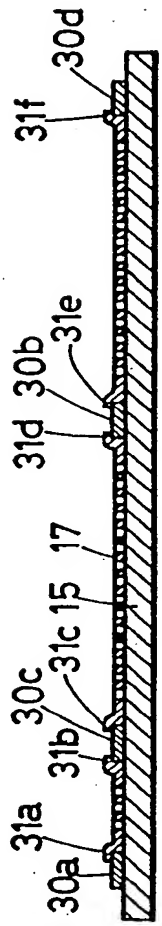

30d
VB
15
31f
30b
31e
31d
17
30c
31c
31b
31a
30a
VB

FIG.5B


31f
30d
31e
30b
31d
17
15
31c
30c
31b
31a
30a

2028576

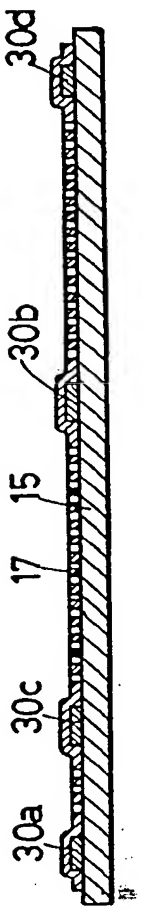


FIG.6

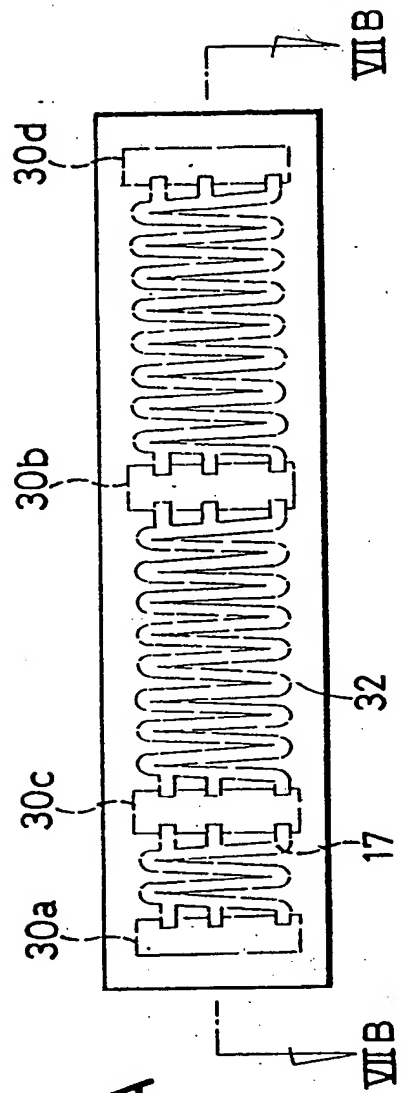


FIG.7A

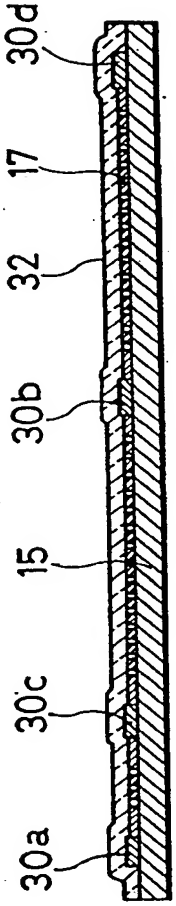
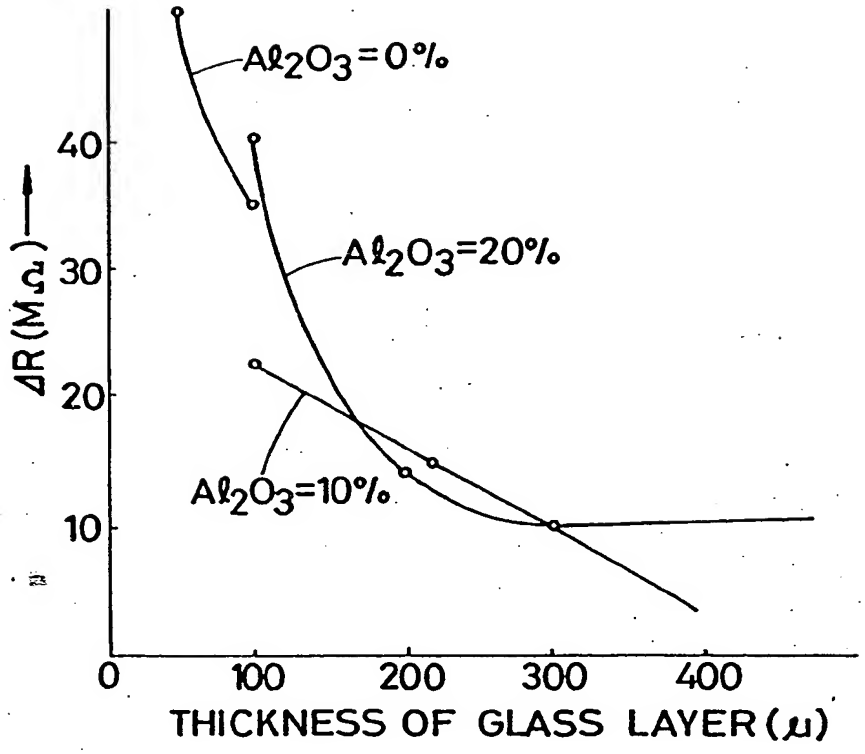


FIG.7B

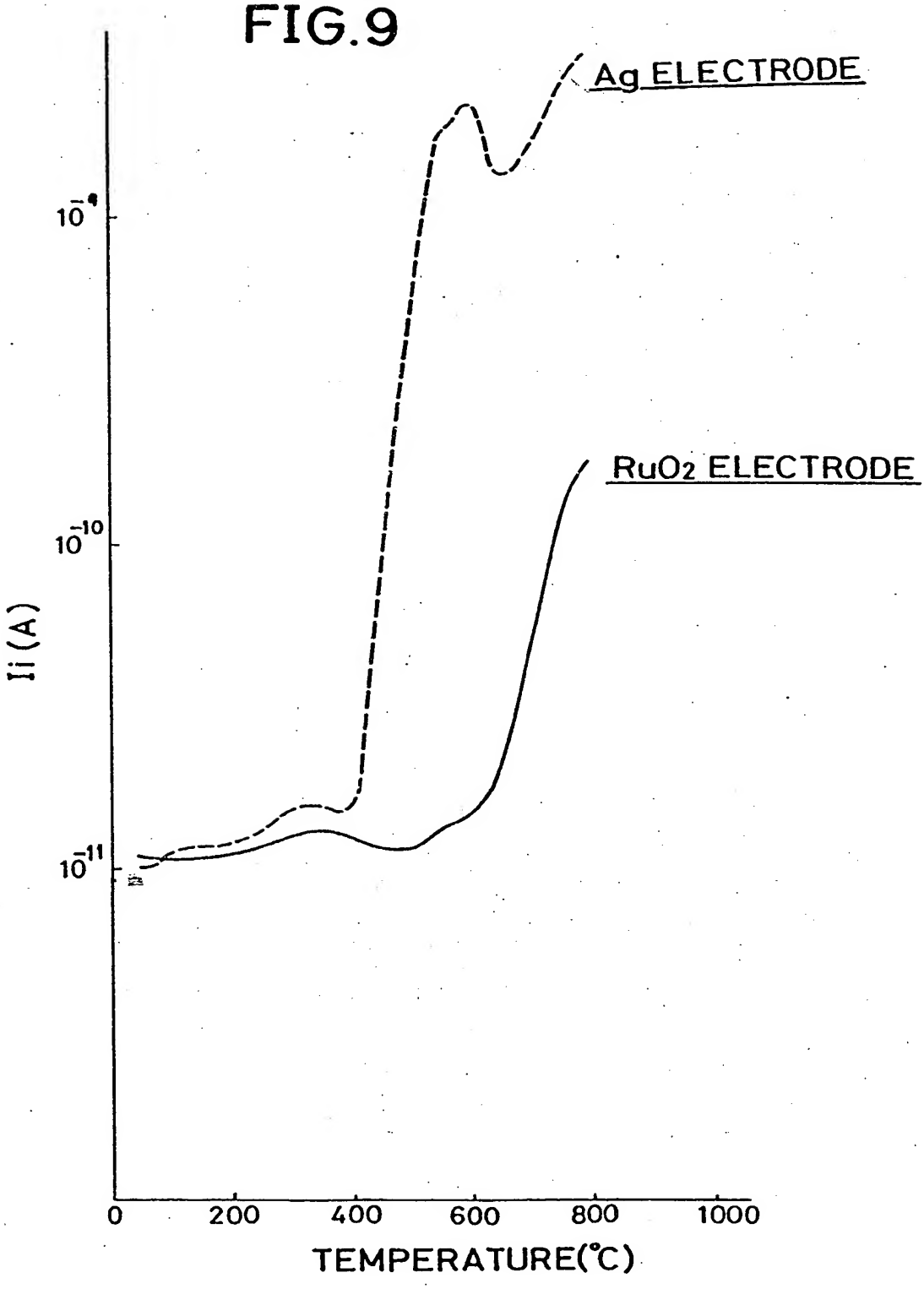
2023576

FIG.8



2028576

FIG.9



SPECIFICATION

Electron guns and resistors for cathode ray tubes

The present invention relates to electron guns for television picture tubes or other cathode ray tubes, and resistors for cathode ray tubes.

In a conventional colour television picture tube, a high voltage such as 25 to 30 KV is applied to the last accelerating electrode of an electron gun unit and a picture screen through an anode button mounted at a funnel portion of the picture tube. At the same time, a voltage of 0 to 5 KV is applied to a focussing electrode forming a focussing electron lens positioned near the last accelerating electrode, through a terminal pin provided at the end of a neck portion of the picture tube.

In order to make a small beam spot on the picture screen, which results in a more precise and clear picture, it is desirable to reduce the aberration of the focussing lens as much as possible. To reduce the aberration of the focussing lens, it is necessary to relax or reduce the voltage gradient between the electrodes. To achieve this, such methods as increasing the distance between the electrodes, applying close voltage to the electrodes, or combination of the above, can be employed.

In the case of applying a similar voltage to the electrodes, it is necessary to apply a high voltage of more than 10 KV to the focussing electrode next to the last accelerating electrode. Such high voltage cannot be applied through a terminal pin provided at the end of the neck portion of the picture tube, because this would give rise to an electric discharge (spark) between the terminal pin and other terminal pins which supply voltage to other electrodes of the electron gun unit, for example, heats. It could be supplied through another button provided at the funnel portion. However, this causes complicated assembly and a substantial increase in cost.

In the case of a picture tube widely known as the "Trinitron" (Registered Trade Mark of Sony Corporation), three electron beams are focussed by a single electron lens, each beam passing through the centre of a single electron lens of large diameter. The three focussed electron beams are deflected to hit the same position of an apertured grille provided in front of the picture screen by four convergence electrodes provided at the top end of the electron gun unit which makes three passages therebetween for each of the electron beams. Two inner electrodes of the convergence electrodes have applied thereto the same potential as the anode potential. Two outer electrodes of the convergence electrodes have applied thereto a voltage which is lower than the anode potential by 0.4 to 1.5 KV, so that the electron beams which pass through the convergence electrodes are deflected to the side of the central beam.

At one time, the voltages were applied through another button provided at the funnel portion and button and the outer electrodes.

Now, a coaxial anode button, which has two cylindrical electrodes electrically insulated from each other, is used to provide an anode voltage through an outer electrode of the anode button, and a convergence voltage through an inner electrode of the anode button and an electrically shielded cable connecting the inner electrode and the convergence electrodes. By virtue of the above coaxial anode button, it is not necessary to provide two buttons at the funnel portion of the picture tube. However, it is still troublesome to connect the inner electrode of the anode button and the outer convergence electrodes by the electrically shielded cable.

Other disclosures of possible interest are our Japanese Publication No. 40987/72 and our US Patent No. 3 514 663, and US Patent No. 3 932 786.

According to a first aspect of the invention there is provided an electron gun for a television picture tube or other cathode ray tube having an evacuated bulb including a funnel portion, a neck portion and a screen portion, comprising a plurality of electrodes for focussing and accelerating an electron beam generated by a cathode, the electrodes being aligned along the axis of said neck portion, and a resistor formed of an insulating substrate on which a resistive path is formed, said substrate being mounted along said plurality of electrodes and sealed in said neck portion, said resistive path having one end tap, another end tape and at least one intermediate tap between said end taps, said one end tap being connected to be supplied with the same voltage as a voltage supplied, in use, to said screen portion, said other end tap being connected to a terminal pin provided at one end of said neck portion for connection to a voltage low enough to avoid an electric discharge between the electrodes and said terminal pin, an operating voltage for the electrodes being obtained, in use, from said intermediate tap by dividing the voltage between both of said end taps, and said resistive path comprising a mixture of ruthenium oxide and glass, said substrate and said resistive path being coated with at least one layer of glass.

According to a second aspect of the invention there is provided a resistor for a cathode ray tube which is to be subjected, in use, to high voltages, the resistor comprising a substrate of insulating material, a resistive path formed on said substrate and comprising a mixture of borosilicate glass and ruthenium oxide, and electrodes formed on said substrate to engage said resistive path, the electrodes comprising a mixture of glass and ruthenium oxide.

The invention will now be further described, by way of illustrative and non-limiting example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an electron gun unit embodying the present invention;

Figure 2 is a schematic drawing showing the

Thus, as shown in Figure 8 in the thickness range between 200 to 400 μm, the change in resistance is very low after knocking and is less than 10 Megohms. The resistivity can be adjusted with the resistor 25, but if the resistivity variation is high it cannot be effectively adjusted.

In Figures 5A and 5B, the terminal top is covered with the resistive pattern and the top is protected from arc discharge by the resistive pattern. One portion must remain uncoated to allow electrical contact to be made to the electrode.

CLAIMS

1. An electron gun for a television picture tube or other cathode ray tube having an evacuated bulb including a funnel portion, a neck portion and a screen portion, comprising a plurality of electrodes for focussing and accelerating an electron beam generated by a cathode, the electrodes being aligned along the axis of said neck portion, and a resistor formed of an insulating substrate on which a resistive path is formed, said substrate being mounted along said plurality of electrodes and sealed in said neck portion, said resistive path having one end tap, another end tap and at least one intermediate tap between said end taps, said one end tap being connected to be supplied with the same voltage as a voltage supplied, in use, to said screen portion, said other end tap being connected to a terminal pin provided at one end of said neck portion for connection to a voltage low enough to avoid an electric discharge between the electrodes and said terminal pin, an operating voltage for the electrodes being obtained, in use, from said intermediate tap by dividing the voltage between both of said end taps, and said resistive path comprising a mixture of ruthenium oxide and glass, said substrate and said resistive path being coated with at least one layer of glass.

2. An electron gun according to claim 1 wherein said taps comprise a mixture of ruthenium oxide and glass.

3. An electron gun according to claim 2 wherein the sheet resistivity of said taps is lower than that of said resistive path.

4. An electron gun according to claim 2 or claim 3 wherein the ratio of ruthenium oxide to glass of said taps is higher than that of said resistive path.

5. An electron gun according to any one of the preceding claims wherein said layer of glass includes alumina.

6. An electron gun according to claim 5, wherein said layer of glass comprises borosilicate glass and alumina with the ratio of alumina to borosilicate glass being in the range of from 5 to 40 weight percent.

7. An electron gun according to claim 5 or claim 6 wherein said layer of glass contains 10 to 40 weight percent of alumina powder.

8. An electron gun according to claim 5, claim 6 or claim 7 wherein the thickness of said layer of glass is in the range of from 100 to 400 μm.

9. An electron gun according to any one of the preceding claims, including guard patterns of the same material as said resistive path formed on the substrate to cover opposite edges of said taps.

10. An electron gun according to claim 9 wherein the sheet resistivity of said guard patterns is the same as that of said resistive path.

11. An electron gun according to any one of the preceding claims wherein there are a plurality of said layers of glass and the uppermost layer thereof does not contain alumina powder.

12. An electron gun according to any one of the preceding claims wherein the thermal expansion coefficient of said glass layer is substantially the same as that of said insulating substrate.

13. An electron gun according to any one of the preceding claims wherein said insulating substrate is of alumina.

14. An electron gun substantially as hereinbefore described with reference to Figures 1 to 4, Figures 1 to 5B, Figures 1 to 4 and 6, or Figures 1 to 4, 7A and 7B of the accompanying drawings.

15. A resistor for a cathode ray tube which is to be subjected, in use, to high voltages, the resistor comprising a substrate of insulating material, a resistive path formed on said substrate and comprising a mixture of borosilicate glass and ruthenium oxide, and electrodes formed on said substrate to engage said resistive path, the electrodes comprising a mixture of glass and ruthenium oxide.

16. A resistor according to claim 15 wherein the weight percent of ruthenium oxide is greater in said electrodes than it is in said resistive path.

17. A resistor according to claim 16 wherein said resistive path at least partially overlays said electrodes.

18. A resistor according to claim 16 wherein said resistive path overlays said electrodes.

19. A resistor according to any one of claims 15 to 18, including a protective layer formed over said resistive path and at least a portion of said electrodes, said protective layer comprising a mixture of glass and alumina.

20. A resistor according to claim 19 wher in the weight percent of alumina to glass is in th range of from 5 to 40.

21. A resistor according to claim 20 wherein the weight percent of alumina to glass is in the range of from 10 to 25.

22. A resistor according to claim 19, claim 20 or claim 21 wherein said protective layer has a thickness of between 100 to 400 μm.

23. A resistor according to claim 21 wherein said protective layer has a thickness of between 200 and 400 μm.

24. A resistor for a cathode ray tube which is to

be subjected, in use, to high voltages, the resistor being substantially as hereinbefore described with reference to Figures 5A and 5B, Figure 6 or Figures 7A and 7B of the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1980. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.